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L8: Entry 2 of 11 File: USPT Apr 14, 1998

DOCUMENT-IDENTIFIER: US 5740186 A
TITLE: Apparatus and method for error correction based on transmission code violations and parity

Brief Summary Text (9):
The effective error rate should be less than 10.sup.-15, perhaps as low as 10.sup.-17.

Brief Summary Text (19):
It is an object of the present invention to provide an improved horizontal parity technique for identifying the location of errors in coded bytes wherein the code does not have local parity and wherein transmission code violations in combination with a limited set (e.g. 8) of parity bits computed from a parameter of each coded byte can locate the error location to a particular byte.

Brief Summary Text (23):
Another broad aspect of the present invention is a method and apparatus for correcting errors in coded bytes of binary data transmitted from a first electronic device to a second device by receiving from said first electronic device a transmitted frame of bits and a first transmitted parity and a second transmitted parity; the transmitted frame contains a plurality of coded constrained bytes of bits; determining a first redetermined parity for the bytes of the transmitted frame; determining a balance bit for each of the plurality of bytes; grouping the bytes into words, each word has a balance bit formed from the balance of each of the bytes in the word; determining a second redetermined parity from the byte and word balance bits; said second electronic device compares the transmitted first parity to the redetermined first parity to determine a bit location of an error in the bytes; the second electronic device compares the transmitted second parity to the redetermined second parity to determine which of the bytes from a sequence of 16 ending with the byte indicating a transmission code violation contains said error; and changing said bit location in said group containing said error.

Drawing Description Text (6):
Table I illustrates error location with 2 levels of balance bits and Fibre Channel Standard transmission code violations.

Detailed Description Text (11):
When using FCS transmission code violations for error locating, Balance Bits BB and BQ are defined for each coded byte and 4-byte word, respectively, with a value of one for balanced blocks and zero otherwise. Sets of 4 BB and 4 BQ bits are each arranged diagonally in separate quadruplets for successive groups of 4 bytes and 4 words, respectively. A parity bit is derived for each of the diagonal bit positions of all the BB and the BQ sets of a frame. Only these 8 parity bits BPAR are transmitted after the end of the frame. For random data, the FCS code by itself locates all single byte errors to a range of 16 bytes except one error in 5.times.10.sup.8 errors. Violations in the received BPAR bits are used to trace an error more precisely to a specific byte of the 16 byte group identified by the code. A set VPAR of 8 vertical parity bits derived from the uncoded data, and the 8 BPAR bits are coded and packed into the first Idle word following the End of Frame. After identification of a faulty byte at the receiver, the VPAR bits are used to correct it.

Detailed Description Text (27):
Lets say an error occurred in a byte with the binary address `0.sub.-- 1110` and did not generate a code violation at that point, but only a disparity violation 3 bytes later at address `1.sub.-- 0001`. In the receiver, the address `1.sub.-- 0001` is recorded. At the end of the frame, PB2 will in violation and thus indicates that the error occurred in a byte with low order binary address `10`. The assumption is that the

error was in the set of 4 bytes ending with the transmission code violation at address `1.sub.-- 0001`. Reducing this address in steps by one until the two low order bits match `10` results in the address `0.sub.-- 1110`, the actual location of the error.

Detailed Description Text (29):
An error will cause a transmission code violation which points to a set of 16 consecutive bytes likely to contain the error. A parity violation in a PQy bit identifies the specific erroneous word from the set of 4 words flagged by the code, and a violation in a PBx bit points to a particular byte in that word. The function of the PQy and PBx quadruplets is solely to enhance the error locating capabilities of the FC transmission code, not to correct the error.